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Comparative Study of Various Measures of Dispersion

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Abstract

Statistical is a subject of mathematics, computers, management, business etc. Central tendency and measures of dispersion are two major aspects of statistical methods. Measures of dispersion are the statistical formula to measure the spread of the data about an average basically dispersion is the measure of the variation of the items. Dispersion refer to the variation among different values of a series if all the value of a series are equal then there is no dispersion but if there is wide variation among different values of a series then dispersion is present at the peak, but in other case dispersion refer to the variation of different values of the series around an average if there is no difference between various values and average then there is no dispersion but if various values are widely scattered around average then dispersion is present at the peak. A good Measure of dispersion must be easy to understand, easy to calculate, well defined. A measure of dispersion is capable of algebraic treatment. There are various types of Measures of dispersion like range, mean deviation, standard deviation. Range is the simplest method of dispersion. it is the difference between the largest value and the smallest value of the variable in the series, range is rigidly defined. Mean deviation is the arithmetic average of the deviations of all the values of the series; mean deviation is the average amount of scatter of the items in a distribution from either the mean or the median. Standard deviation is the square root of the arithmetic mean of the squares of all the deviations.

Keywords

Measures of dispersion; Range; Mean deviation; Standard deviation.

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1. Introduction of Measures of dispersion

The word dispersion has two distinct meanings. In one sense, dispersion refers to the variation among different value of a series. If all the values of the series are equal, there is no dispersion. On the other hand, If there is wide variation among different values of a series, dispersion is present to a greater extent. In second sense, dispersion refers to the variation of different values of the series around an average. If there is no difference between various values and average, there is no dispersion. On the other hand, if various values are widely scatter around average, dispersion is present to a greater extent. Hence, it can be said that dispersion is the statistical tool which measure the extent of variation in different values of a series among themselves. The technique of calculation of a good measure of dispersion should be simple and easy so that it is easy to be calculated. A good measure of dispersion must be easy to understand. If it is difficult to be understood, then its usefulness is reduced. A good measure of dispersion should be capable of algebraic treatment. It means it should be based on algebraic methods and hence there should be possibility of making adjustments and amendments in it as per algebraic methods. A good measure of dispersion must be free from personal bias. All the values must be given equal importance during its calculations. Its calculations must not be influenced by the personal choice. The measure of dispersion is rigidly defined it should be based on all observations of given series; it should not be affected by extreme observations. So one can say that a measure of dispersion must be well defined, easy to calculate and understand and it should be based on all the items. It should not be affected by personal bias of the researcher or extreme values in the series. The following section provides introductory knowledge about various measures of dispersion.

1.1 Range

Range is the simplest possible measure of dispersion. Range is defined as the difference between the two extreme observations of distribution. That is range is the difference between the value of largest and smallest item of the distribution. Range is simple to calculate and understand. Range is highly useful in quality control measure. Quality control measure are prepared and studied on with the help of range. Range is well defined; it can be easily understood and interpreted from its definition, even by a common man. It is the easiest to calculate and the simplest to understand, not only among various measures of dispersion, but perhaps in the whole of the statistics. Range provides prompt knowledge about dispersion in the series. The series may provide knowledge about dispersion if range is used as measure. Range is practically highly useful in quality control measures. Quality control charts are prepared with the help of range. Range is a cost effective measure, it saves a lot of time and effort.

1.2 Mean Deviation

Mean deviation is a well defined measure of dispersion. It can be easily understood and interpreted even by reading its definition. As a measure of dispersion, Mean deviation is easy to calculate and simple to understand. Mean deviation is not affected by extreme values. It gives equal importance to all the values. Particularly, when it is calculated from median, extreme values have least effect on it. Mean deviation is a useful measure of dispersion for making comparative analysis of the series. Mean deviation measures the dispersion or variation in the different values of a series. Mean deviation has practical usefulness in various fields like Economics, commerce, statistics; Mean deviation is the arithmetic average of the deviation of all the values of the series taken from any of the measures of central tendency (Mean, Median, or Mode). The mean deviation is the arithmetic average of the deviation of the group, sum divided by their number. It may be said that mean deviation is the average difference between the values of a series and mat any of its measure of central tendency hence, mean deviation may be calculated either from mean or median or mode. Theoretically, mean deviation from median is considered to be the best as the sum of the absolute values of the deviations is minimum when these deviations are taken from median. When deviations are taken from mean, we get mean deviation from mean. When deviations are taken from median, we get mean deviation from median. When deviations are taken from mode, we get mean deviation from mode.

1.3 Standard Deviation

The standard deviation is defined as the positive square root of the arithmetic mean of the squares of the deviations of given observation of their arithmetic mean. The standard deviation is independent of change of origin but not of scale. It is minimum value of root mean square deviation or sum of squares of deviations is minimum about mean. Standard deviation is always less than or equal to range. It is suitable for further mathematical treatment. Standard deviation is rigidly defined and it possesses a definite value. It is based on all the observations of distribution. It is suitable measure of dispersion for further mathematical treatment and statistical analysis. In comparison to other measures of dispersions, standard deviation is affected least by sampling fluctuations. In order to remove these drawbacks of mean deviation Karl Pearson introduce the concept of standard deviation. Standard deviation is the most widely used measure of dispersion. Standard deviation is independent of change of origin. It means if a constant value is added to or subtracted from all the values of the series, standard deviation is not affected and its value remains the same. Standard deviation is not independent of change of scale. It means if all the values of the series are multiplied with or divided by a constant value, Standard deviation is affected accordingly and its value changes. Standard deviation is capable of algebraic treatment, whereas mean deviation is not capable of algebraic treatment. Standard deviation is practically more useful in statistical analysis than mean deviation.

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2. Comparison of various measures of dispersion

Sr.no.	Parameters	Range	Mean deviation	Standard deviation
1.	**Concept**	It is the difference between the largest and the smallest value of the variable.	It is the arithmetic average of the deviation of all the values of a series.	It is the square root of the arithmetic mean of the squares of all the deviations.
2.	**Criteria**	It is highly useful in quality control measure.	Deviations of values may be taken from any measure of central tendency.	Deviations of values are taken only from actual mean of the series.
3.	**Objective**	It only calculates the difference between the largest and the smallest number.	In mean deviation only deviations are added.	In Standard deviation only square of deviations are added.
4.	**Output**	Range provides the minimum and maximum value.	Absolute values of deviations are taken. All the deviations are taken to be positive and negative sign are ignored.	Negative sign are neutralized by squaring the deviation.
5.	**Functionality**	It provides knowledge about dispersion in the series.	Simply average of the absolute values of deviations is taken.	Square root of the arithmetic average of square of deviation is taken.
6.	**Capability**	It is not capable for algebraic calculations.	It is not capable for algebraic calculations.	It is capable for algebraic calculations.
7.	**Usability**	It is not useful for statistical analysis.	It is less useful for statistical analysis.	It is more useful for statistical analysis.
8.	**Reliability**	Range has a lack of reliability.	It is more reliable than range.	It is very much reliable than range and mean deviation.
9.	**Stability**	Range is unstable.	Mean deviation is stable.	Standard deviation is stable.
10.	**Cost Effectiveness**	It is time and cost effective.	It is not time effective.	It is not time effective.
11.	**Data Distribution**	It is not useful for frequency distribution.	It is useful for frequency distribution.	It is very much useful for frequency distribution.

3. Conclusion

From the above discussion it is concluded that the measures of dispersion is well defined, easy to understand and easy to calculate. It is capable for algebraic calculations. It is also free from personal bias. The range provides us to find the difference between the largest and the smallest numbers in the set. Range is also cost effective measure of dispersion; with the help of range we save lot of time and effort. In mean deviation, the deviation of value may be taken from any measure of central tendency. Mean deviation has May useful in different fields like economics and commerce. In standard deviation, it is capable for algebraic treatment and it is practically more useful in statistical analysis. Standard deviation also provides the reliability.

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